Improving the NCEP Climate Forecast System (CFS) through enhancing its land modeling component

Fei Chen[1], Michael Barlage[1], Michael Ek[2], Rongqian Yang[2], Jesse Meng[2], and Zong-Liang Yang[3]

[1] Research Applications Laboratory, National Center for Atmospheric Research, Boulder, CO 80301, USA
[2] NCEP/EMC
[3] University of Texas at Austin

This paper summarizes a Research to Operation (R2O) effort sponsored by the NOAA MAPP-CTB program. The overarching goal of this effort was to explore the impact of enhanced representation of vegetation-hydrology interactions on the NCEP Climate Forecast System (CFS) seasonal perditions. The land modeling component in CFS was enhanced by implementation of: 1) new global MODIS-based IGBP-NCEP land-cover dataset and a new hybrid global soil texture dataset; 2) a new version of Noah V3.4; and 3) the new community Noah with multi-parameterization (Noah-MP) land surface model. Those new additions brought the CFS land modeling component closer to recent community efforts. A number of T126 CFS reforecast experiments with different choice of land models and specification of vegetation seasonality were carried out for selected eleven years (1982, 1987, 1996, 1988, 2000, 2007, 1986, 1991,1999, 2011, 2012) with four ensemble members (00z of May 1 to May 4), and evaluated against the CTB reforecast evaluation benchmarks. The results showed significant effects of the vegetation phenology evolution and its interaction with underground water on CFS seasonal prediction skills. Using the Noah-MP with ground-water and dynamic vegetation parameterizations in CFS produced increased seasonal prediction skills in summer precipitation and surface temperature. Such vegetation-crop-hydrology interactions and their impacts were amplified with increased spatial resolutions, and hence are expected to be more significant in high-resolution NGGPS/UFS forecast models. The enhanced Noah-MP land modeling capabilities were transitioned to various NGGPS/UFS models and to the operational National Water Model V1.2.